Seat No.: _____ **Enrolment No._____**

GUJARAT TECHNOLOGICAL UNIVERSITY

ME Semester –I Examination Feb. - 2012

Subject code: 714402N **Date: 13/02/2012**
Subject Name: Advanced Digital Signal Processing
Time: 10.30 am – 01.00 pm **Total Marks: 70**

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1 **(a)** Determine the Following Systems are Linear or Nonlinear **07**
(1) $Y[n] = X[n^2]$ and (2) $Y[n] = X^2[n]$

(b) State and Prove the "Differentiation Property" of Z-Transform and determine Z-Transform of $x(n) = n^2u(n)$ **07**

Q.2 **(a)** (1) Compute the Discrete Fourier Transform (DFT) of sequence $x[n] = \{1, 0, 0, 1\}$. **07**
(2) Find the Convolution of two sequences.
$h[n] = \{1, 2, 1, -1\}$ and $x[n] = \{1, 2, 3, 1\}$

(b) List the methods for finding Inverse Z-Transform and find the Inverse Z-Transform of the Following using Partial Fraction Expansion(PFE) Method **07**

$$X(z) = (Z^{-1}) \ / \ (1 - 0.25Z^{-1} - 0.375Z^{-2})$$

OR

(b) Explain "Decimation in Time Fast Fourier Transform (FFT)" algorithm fundamentally. **07**

Q.3 **(a)** Why FIR Filter is called "Finite"? Obtain the Coefficients(First Three and Last) of an FIR Filter to meet the specification below using "Hamming Window Method" **07**

Pass Band Edge Frequency	1.5 KHz
Transition Width	0.5 KHz
Stop Band Attenuation	> 50dB
Sampling Frequency	8 KHz

(b) (1) A Simple LRC Notch filter has the following normalized s-plane Transfer Function **07**

$$H(s) = (S^2 + 1) / (S^2 + S + 1)$$

Determine the Transfer Function of an equivalent discrete-time filter using Bilinear Z-Transform (BZT) Method. Assume a Notch frequency 50Hz and Sampling Frequency 500Hz

(2) Compare FIR Filter and IIR Filter.

OR

Q.3 **(a)** Consider discrete time linear causal system defined by difference equation: **07**

$Y[n] - 3/4\, Y[n-1] + 1/8\, Y[n-2] = X[n] + 1/3\, X[n-1]$

Obtain Cascade Realisation for IIR System

(b) What do you understand by "Matched Z-Transformation" for coefficient calculation? Explain briefly. **07**

Q.4 **(a)** What is the Need for "Multirate Signal Processing"? Explain the Process of Decimation and Interpolation with Example. **07**

(b) Explain "Recursive Least Squares" algorithm with neat sketch and necessary equation. Mention its Limitations **07**

OR

Q.4 **(a)** Explain basic "Wiener Filter" theory with neat sketch and necessary equation. Mention its Limitations **07**

(b) Implement Single stage Decimator for the Following Specification: **07**

Sampling Rate of Input Signal: 20000Hz
M =100
Transition Band = 40Hz to 50Hz
Pass band Ripple = 0.01
Stop ban Ripple = 0.002

Also Draw Two Stage Decimation Process for above Specification

Q.5 **(a)** List the Various applications of DSP and explain any one in detail. **07**

(b) What do you understand by the term " Pipelining" and explain "Three stage Pipelining" with "Timing Diagram" **07**

OR

Q.5 **(a)** What is Principal feature of "Harvard Architecture"?. Explain it with Timing Diagram. How it is differ from Non-Harvard Architecture. **07**

(b) With Neat Sketch and Explain Architecture of TMS320C67XX DSP Processor **07**

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